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ABSTRACT

The materials in this educational packet are designed for use with students in grades 4 through 7. They consist of an overview, three lesson plans and student data sheets, and a poster. The overview describes how the freshwater marsh is an important natural resource for plant, animal, and human populations and how the destruction of marshes causes a wide network of ecological problems (from decline in water quality to loss of plant and animal species). A glossary and list of reference materials are included. The lesson plans provide a list of learning outcomes, instructional strategies, a list of materials needed, and a quiz (with answers). The activities in the lessons involve: (1) studying marsh organisms and succession in marshes; (2) playing the role of early settlers (while learning about food webs); and (3) building a model of a marsh. The poster highlights many animals and plants found in a freshwater marsh and marsh succession. A puzzle dealing with a simple food web is also included. (JN)

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Freshwater Marsh

Habitat Pac

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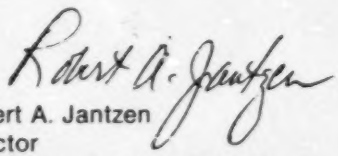
This education package represents an important step in our efforts to provide teachers and other educators with factual information about wildlife, habitat, and resource management. We hope that you find these materials useful and that you will encourage your students to learn more about America's wildlife heritage.



Robert A. Jantzen
Director
U.S. Fish and Wildlife Service

These materials are designed for use with students in grades four through seven.

Contents

Habitat Overview
This presents the freshwater marsh as an important natural resource for plant, animal, and human populations. The destruction of marshes causes a wide network of ecological problems, from decline in water quality to loss of plant and animal species. Bold face words are explained in the Glossary; additional materials are listed under Resources.

Poster: Side 1
This beautiful painting highlights many animals and plants found in a freshwater marsh. The poster introduces the subject as part of a colorful display.

Poster: Side 2
Marshes change and this poster depicts the succession of the marsh, from an early, open state to a mature, filled area with almost no water.

Student Page: Food Web Puzzle
Students will enjoy solving this simple food web.

Lesson Plan 1: Marsh Succession
On a field trip, students will really "get their feet wet" as they sample the soil and organisms in and around the marsh. This exercise teaches scientific sampling methods and allows students to investigate the rich variety of marsh creatures and explore natural changes in the animals' communities.

Lesson Plan 2: Marsh Settlers
Here students imagine they are settlers from days gone by, looking for cabin sites and food sources in the marsh terrain. They learn about food webs.

Lesson Plan 3: A Model Marsh
This indoor lesson reinforces the field trip activities by having the student build a model marsh. Instructions include methods to illustrate water-holding properties of marshes, and "planting" the marsh according to the students' outdoor observations.

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The Institute is the only private national conservation organization with programs dealing almost exclusively with fish and wildlife in urban and other disturbed areas. Funded through private and corporate contributions, grants and contracts, it is filling some of the glaring gaps in information and methodologies needed for the management and enjoyment of wildlife and wildlife habitats in urban areas.

The Institute accomplishes its mission by (1) conducting sound research on the relationship between man and wildlife under urban and urbanizing conditions; (2) discovering and disseminating practical procedures for maintaining, enhancing or controlling certain wildlife species in urban areas; and (3) by building an appreciation for, and understanding of, wildlife and a positive conservation ethic at the local community and neighborhood level, and illustrating how all segments of our people have a vested interest in wildlife and the environment we mutually share.

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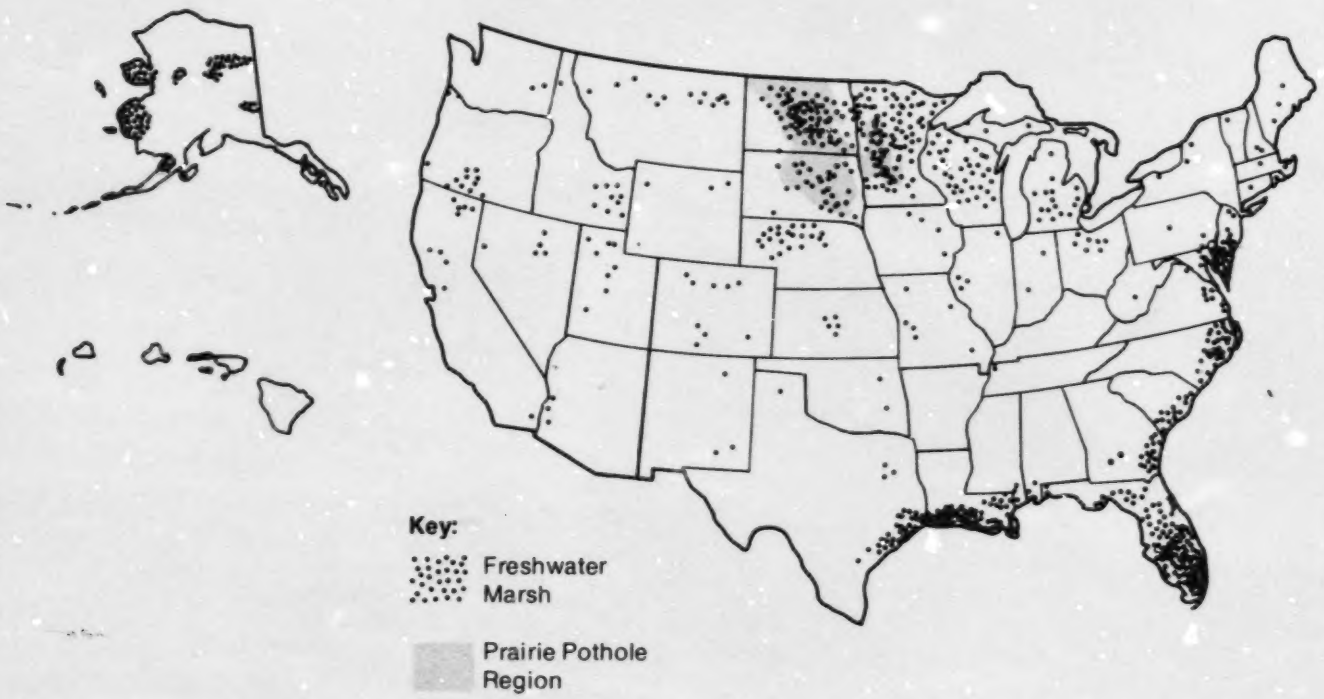
Freshwater Marsh Habitats of the United States



Freshwater Marsh

Habitat Overview

Few people realize the importance of **freshwater marsh** resources to the early settling of America. Trappers in search of beavers and other furbearers that were abundant in marshes, mapped rivers and founded outposts. These outposts later grew into cities such as Chicago, Detroit, and New Orleans. Settlers utilized the freshwater marshes' natural resources. Fish and game harvested there filled many tables. Marshes provided reeds for caning and marginal grazing land for livestock.

Too often, though, marshes were viewed as mosquito-infested wastelands to be used for dumping grounds or to be "improved"—drained or filled for agriculture or construction. Drainage had begun by George Washington's time, and alterations of freshwater marshes and other wetlands have since been carried out on a massive scale. It is estimated that today the United States has already lost 45 percent of its original wetlands acreage.

During the past few decades, people have begun to realize the ecological values and benefits of freshwater marshes. These valuable functions were noticed when they were interrupted due to wetland destruction.

One of the first values observed was the marshes' importance as habitat for wildlife, particularly waterfowl. As wetlands were destroyed, populations of ducks and geese declined. By 1956, the U.S. Fish and Wildlife Service had developed a wetlands classification system based on their value to wildlife and instituted programs to protect wetlands. At first wetland preservation was focused in terms of wildlife habitat. Now people are discovering that wetland preservation can provide some alternative solutions to water supply problems (floodwater storage, **groundwater recharge,** wastewater filtering).

Ecology

A freshwater marsh is an open area, dominated by nonwoody, or herbaceous, plants. Often the vegetated areas are interspersed with patches of open shallow water. Marshes may be flooded for all or only part of the year. However, they must be flooded enough to sustain herbaceous vegetation that is adapted to living in water-saturated soils—plants like cattails and bulrushes.

The freshwater marsh is one of several kinds of wetlands. Other wetlands include bogs, swamps, and salt marshes. They are formed in low-lying areas on river flood plains and coastal plains and in depressions formed by glaciers. Wetlands are more than their name directly implies—

more than just soggy earth, a mere interface between land and water. They are unique ecosystems, different from either land or water.

Freshwater marsh communities include a variety of unique plants and animals. The exact species composition of any particular marsh depends on many things: geographic location, water chemistry, depth and duration of flooding, season, and climate. Most freshwater marshes are very productive habitats. They produce more plant matter per **hectare** (2.47 acres) each year than cropland; and marshes don't need the addition of supplemental fertilizer.

Marsh animals feed on the plants and on each other in what are biologically known as "food chains." Of course, few animals eat only one kind of food, so these simple "food chains" are woven together into a complex "food web." (See Student Page.)

Marsh Wildlife

Freshwater marshes are vital wildlife habitats. Their high productivity supports a variety of creatures. During the breeding season, marshes provide cover, food, and nesting areas. The myriad voices of the spring chorus of frogs and toads reflect

Leopard Frog

this abundance of creatures. Salamanders congregate briefly to lay eggs. The newly spawned fry of sunfish, bass, and bullheads hide among the plants. Birds—songbirds, shorebirds, and waterfowl—raise their broods in nests among the reeds and cattails. During migration and in the winter, birds use marshes for feeding and resting areas. Many mammals, such as deer, and furbearers like the muskrat, live on the marsh or visit it to feed.

Changing Marshes

Marshes are constantly changing, gradually filling in and becoming land. This takes place through the natural inflow of soil and organic matter from the surrounding area, and through the buildup of dead plant material. As the water becomes shallower, cattails will grow farther out into the open water of the marsh. As the edges of the marsh become drier, the marsh slowly turns into a sedge meadow and may eventually become a forest. This gradual process is known as **succession,** normally occurring over a period of hundreds or thousands of years.

Humans can accelerate the process of succession through carelessness. Marshes fill in by **sedimentation** when **erosion** results from construction or farming in the marsh's **watershed.** Fertilizer runoff from nearby farms and lawns can increase plant growth in the marsh. When the plants die, their decay robs the water of oxygen necessary for fish and other aquatic organisms to sustain life.

In some instances the process of succession is naturally reversed, and new marshes are slowly created or old ones renewed. Over long periods of time, changes in rainfall and the course of rivers, the movements of glaciers, and the geological lifting of the land create new places for wetlands to form. Old, grown-in marshes can be rejuvenated when localized fires burning through the vegetation reopen water pools. The fires release nutrients stored in the dead vegetation and thus contribute to the maintenance of the marsh.

Animals also change wetlands. Muskrats—cutting cattails and bulrushes for food and to

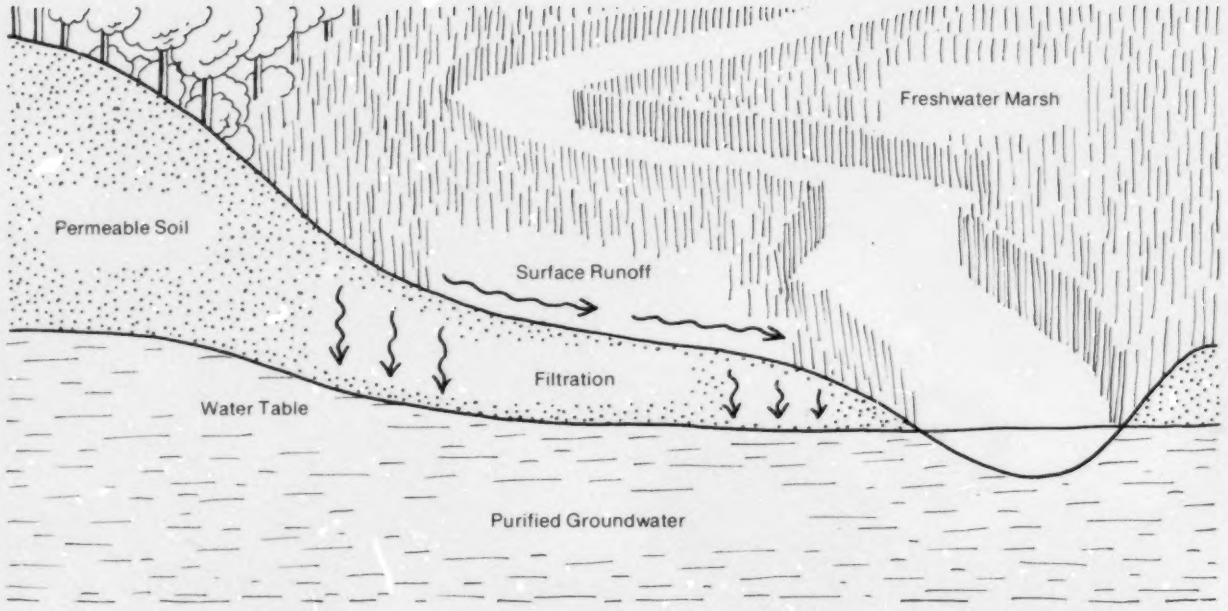
Giant Water Bugs

build their houses—can control the abundance of marsh vegetation. Muskrat "eat-outs" open up dense marshes, making more suitable habitat for ducks and fish that require some open water for swimming and feeding.

Beavers are best known for creating or changing marshes. Beaver dams, sometimes very large, cause flooding and create new wetlands. Forests are "opened up" as trees are killed by the standing water. In a few years the beavers move on to build a new dam elsewhere, leaving a moist meadow behind. This repetitive pattern was more common during the early settlement of this country when beaver populations were more widespread.

Water Resources

Freshwater marshes have important water resource values. Flood control is a natural function of marshes. Their soils and vegetation act as natural "sponges" that have a tremendous ability to absorb and retain excess water. This storage capacity can save the adjacent area from flood damage. During severe flooding in eastern Pennsylvania in 1955, the only two bridges surviving undamaged were located below a large cranberry bog. The presence of wetlands along shores and riverbanks also helps to



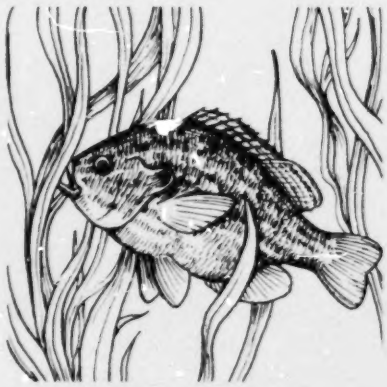
Groundwater Recharge from a Freshwater Marsh.

protect these areas from erosion. The dense root systems of the marsh plants hold soil that would otherwise be washed away.

Some of the water stored in marshes evaporates; some may be fed out slowly into streams. Still more of the water may seep underground to recharge the groundwater table. Whether this recharge occurs depends on the soil layers between the marsh and the groundwater. Where the soil is permeable, water will seep through. Recharge is important, especially where groundwater is being pumped out to supply human needs. When marshes are destroyed, rainwater, instead of being stored and seeping back to the water table, runs off and is no longer available for use in that area. Many areas now faced with groundwater depletion would have less serious problems if their wetlands were intact.

Wetlands also function as filters, removing pollution and sediments from water flowing through them. The slow rate of flow through marshes allows solid particles such as sand, silt, and clay to settle out. Nutrients in the water are broken down by bacteria and other microbes and absorbed by plants.

When wetland areas are developed—drained, **dredged,** filled, or channelized—wastes discharged there are no longer purified by normal biological processes. This results in pollution of the water supply. Wetlands can provide this purifying function only to a limited degree. Large amounts of pesticides or heavy metals, for instance, overload the system and threaten all marsh wildlife. Research is currently being conducted on the capacity of marshes to function as sewage treatment plants. Some marshes can process human waste with only minimal impact so long as nutrient loads are not excessive and the contents not too toxic.



Pumpkinseed Sunfish

Management

Most freshwater marsh management today is done by State and Federal agencies, private conservation organizations, and groups interested in hunting. Traditional management programs have been based more on "common sense" than on a real understanding of the functioning of wetland systems. Intensive research is being conducted on wetland ecology to provide a better basis for making management decisions.

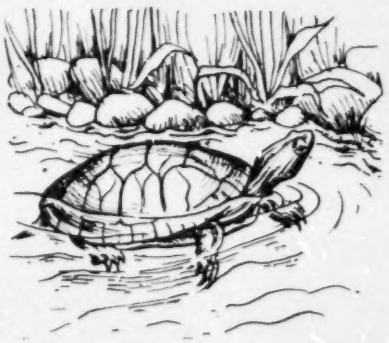
Specific management techniques can be used to improve freshwater marshes for wildlife. Building islands and sowing food plants provide nesting areas and food for marsh wildlife. Techniques can be used to increase natural marsh plant populations wherever water levels can be controlled. The water is "drawn down" in the spring, allowing plants to grow in areas where water was previously too deep. These areas are then reflooded in the fall to make the food available to migrating waterfowl.

Blasting, flooding, and plant cutting are used to create open water areas in very dense marshes. The feasibility of establishing marsh vegetation in normally

drier areas is also being researched with some success. In many cases, the only management a marsh needs is preservation.

Marsh Values

Freshwater marshes are too valuable to be unthinkingly destroyed. Before signing them over for development, people must consider the marshes' importance to the ecosystem. The marshes' connection to the groundwater and potential importance for flood control should be determined. A scattering of marshes is important, providing "habitat islands" for wildlife. Marsh plants help maintain the balance of gases in the air by taking in carbon dioxide and releasing oxygen. Freshwater marshes are valuable as open space, recreation and historic sites, scientific study areas, and for esthetic enjoyment.



Western Painted Turtle

Protecting Our Marshes

As people increasingly recognize the importance of wetlands, laws are being enacted to protect them. The Federal Clean Water Act (Section 404) now requires permits to be issued before dredging or filling of wetlands. Executive Order 11990 also provides for wetland conservation so that Americans will "protect against the cumulative effects of reducing our total wetlands acreage."

Despite these measures, the United States is still losing 300,000 acres of wetlands every year. More public support is still needed for programs encouraging conservation of freshwater marshes.

Glossary

dredging—Deepening a waterway by digging up the bottom.
erosion—The wearing away of soil by water or wind.
freshwater marsh—A wetland that contains freshwater and is dominated by herbaceous vegetation such as cattails and reeds.
groundwater recharge—Replenishment of the underground water supply.
hectare—Measurement of area in the metric system; 1 hectare (10,000 m^2) = 2.471 acres.
sedimentation—The process of suspended solid materials (e.g., sand, silt, plant matter) settling out of water.
succession—A gradual, natural sequence of changes in the plant and animal communities occupying a given area.
watershed—The area of land that drains into a particular body of water.

Resources

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Year on Muskrat Marsh, Berniece Freschet. Charles Schribner's Sons, New York, 1974.

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Department of the Interior/U.S. Fish and Wildlife Service, 1980

Freshwater Marsh

Lesson Plan 1 — Marsh Succession

Purpose

This activity helps students become familiar with some of the organisms that live in the marsh and with the gradual succession of marshes into dry land.

Learning Outcomes

After completing this activity, the students will be able to:

A. Arrange several pictures or descriptions of different stages of marsh succession in the correct time sequence.

B. Indicate on an attitude scale how they feel about management of marshes.

C. Construct a transect sample of a habitat.

Organization

Who: Groups of 3 or 4

Where: Freshwater marsh

When: Any season—spring is preferred

Time: 1 to 2 hours

Safety: This activity takes place near open water: Caution students not to go far into open water; add snake warning if appropriate for your area.

Materials: For Each Group

- Pond guide (1 per group, if possible)
- Insect repellent
- String, 7 meters (20 feet)
- Scraper (cup)
- White pan or tray
- Magnifying glass or hand lens (optional)

Materials: For Each Student

- Student Data Sheet
- Pencil
- Clipboard (Masonite or stiff cardboard with a paper clip or binder clip)

Directions

1. In the classroom, introduce the concept of succession by using Side 2 of the poster.

2. For the field trip, make sure students dress properly. They will get their feet wet, so they should wear boots or change into old sneakers that can get muddy. Form students into groups and distribute all materials to each group.

3. At the marsh, go over safety precautions.

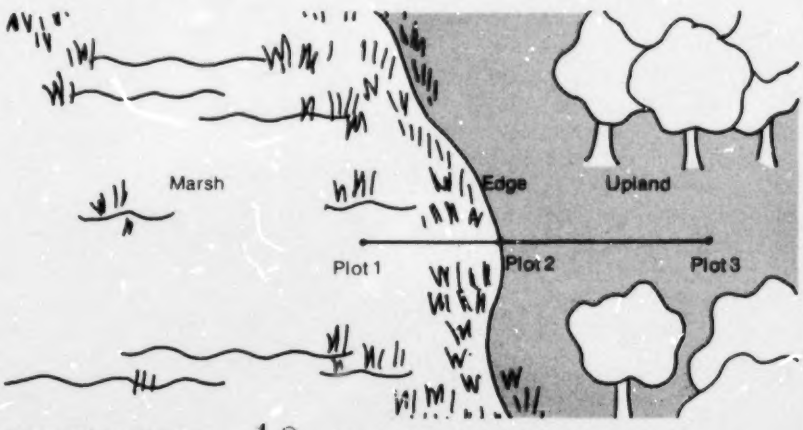
4. Instruct each group of students to establish a *transect line* at the edge of the marsh, using the 7-meter (20-ft) string. One end of the string should be staked 1 to 2 meters (3–6 ft) inside the marsh depending on water depth. The other end should be staked on dry land. The line should be at right angles (90°) to the marsh edge, as shown in the diagram.

5. Three sample plots of clipboard size should be taken along this line: plot #1—1 to 2 m (3–6 ft) inside marsh; plot #2—at marsh border; plot #3—at the upland end of the line. The plots need not be equidistant.

6. Students should define the area of their sample plots by holding their clipboards over the ground or water next to the appropriate points on the line and marking the corners with sticks.

7. Students should then look for all the different kinds of organisms—both plants and animals—they can find within the plot. Be sure they check plant leaves and look under rocks. Along one edge they should collect 2 to 3 cm (about 1 in) of soil, spread it in the tray, and check carefully for living things. On the Data Sheets, students should identify the organisms—describe, name (using the pond guide), or draw them—and record the numbers of each and where found (e.g., on a leaf, under the soil).

After they look for organisms in the soil, the students should examine the soil itself. What is its texture—fine or coarse? Is it wet or dry? What does it seem to be made of? Allow 20 to 30 minutes for each of the three plots.



Transect Line Diagram

8. After the students complete each sample, they should replace all rocks and logs before going to their next plot. Through discussion, point out that the habitat should be returned as nearly as possible to its natural state so that the organisms living there may survive.

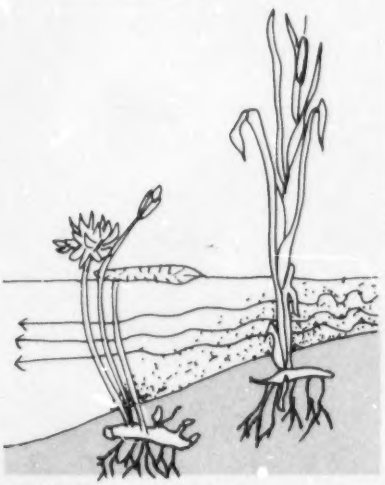
9. Gather the students together to discuss their findings. What kinds of organisms did they find in each plot? Were the organisms very similar? How were their habitats different? What signs were there that succession is actually occurring?

Discuss differences in soil among the plots. The soft soil being accumulated among the waterlilies, cattails, rushes, or sedges is the buildup of dead plant material and soil washed in from the surrounding area. What will happen as this buildup continues? How do marshes change with time? (In some cases, the buildup of soil and plant material will slowly fill the marsh—see Habitat Overview.)

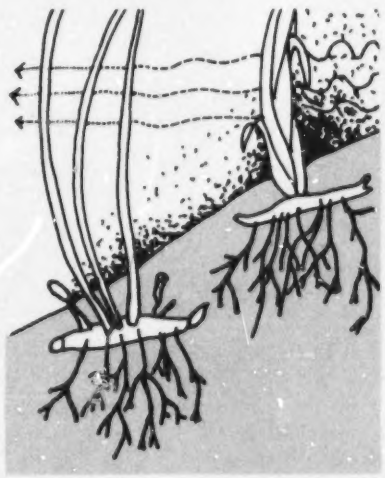
Followup

Now that the students have seen the natural process of change in a marsh, discuss some of the changes that can be induced by human activities and management. What would happen if development in the surrounding areas increased the amount of soil being washed into the marsh? (Increased sedimentation would cause the marsh to fill faster.) What would happen if the water level were raised? (Some plants would die and the marsh would be opened up.) Discuss how such changes affect wildlife in the marsh. (Higher water levels might open up the marsh and provide better habitat for waterfowl. However, the loss of vegetation might reduce muskrat populations since they would have less food.)

Soil-building Process in the Marsh



a. Water carrying eroded soil is slowed as it flows through heavily rooted bases of cattails and waterlilies.



b. Soil settles out around plant roots.

c. Dead plant material falling into the water also builds soil.

Quiz Answers

1. The correct sequence is: B—C—A. Usually, as a marsh grows older, it fills in and becomes drier. There is progressively more emerging vegetation and less open water.

2. The students' drawings should be similar to the one in the lesson plan. The transect line should cut through the different habitat zones. One sample plot should be drawn in each zone. In this way the sampling will show different types of habitats and of marsh organisms.

3. There is no correct answer for this question. Student answers can be used to develop a class discussion on the values of marshes. How are marshes manipulated (managed)? What are some values and/or problems associated with that manipulation?

4. Upland habitat: A-tree (red oak); F-earthworm.

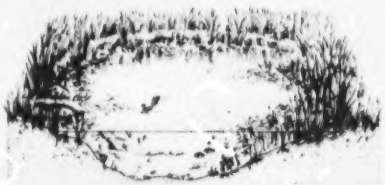
Marsh habitat: B-cattail; C-turtle (Western painted turtle); D-bullfrog; E-muskrat.

Freshwater Marsh Lesson Plan 1 Quiz

Name:

1. These pictures show a marsh growing older in three stages.

a.



b.

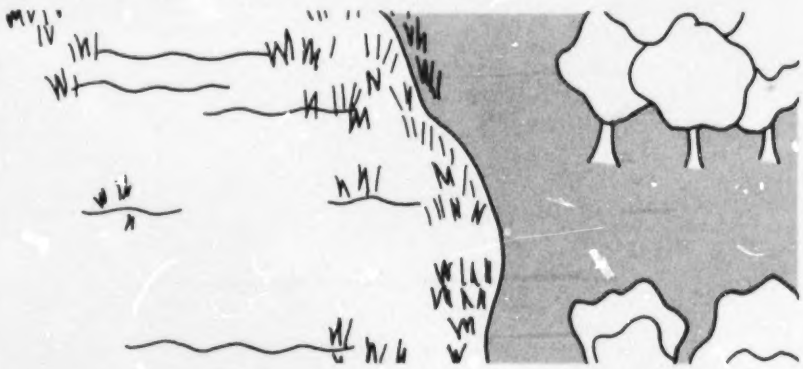
c.

Which one would you see first? _____

Which one would you see next? _____

Which one would you see last? _____

2. How would you take a transect sample of this area?
Draw in your sampling line.



3. Do you think that marshes should be left alone for natural succession? Or, do you think that people should control succession in marshes?

Put an X in the box that shows how you feel.

All marshes should be left alone.	Succession should be controlled only in marshes that are affected by people's actions (increased erosion or fertilizer).	Succession should be controlled in marshes wherever this control might increase wildlife populations.	Succession should be controlled in marshes wherever possible.

Name:

4. These pictures **A, B, C, D, E,** and **F** are of plants and animals found in or near a marsh.

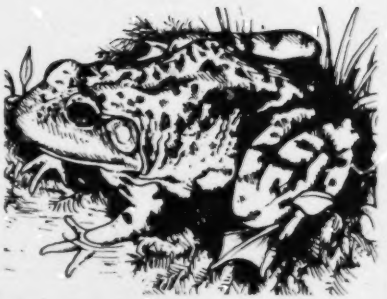
Which ones would you expect to find ***In the marsh habitat?*** Which ones would you expect to find ***In the upland habitat?***

Write MARSH or UPLAND under each picture.

A

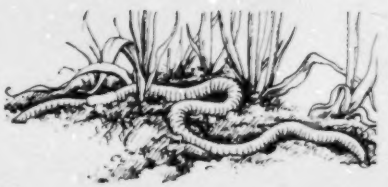
B

C



D

E



F

Department of the Interior/U.S. Fish and Wildlife Service, 1980

Freshwater Marsh

Lesson Plan 2

Marsh Settlers

Purpose

In this activity students will take a field trip to investigate a freshwater marsh from the point of view of pioneers settling the area. Students will learn about food webs and their place in them. They will evaluate the marsh as a source of food and shelter.

Learning Outcomes

After completing this activity, the students will be able to:

A. Identify the values of the marsh to humans.

B. List two reasons why settlers might not want to live near a marsh.

C. Draw a food web containing at least five elements of which the student is one.

D. Name two marsh plants that pioneers might have used for food.

Organization

Who: Groups of 5 to 6
Where: Freshwater marsh
When: Spring, summer, or fall
Time: 1 to 2 hours
Safety: **a.** This activity takes place near open water. Where the water is deep, identify the nonswimmers; organize the class in a buddy system for water safety. There should be at least one adult for every 10 students.
b. Wild food plants: Students must not eat any plants they find as potential wild food sources.

Materials: For the Group

- Guides to edible wild plants
- Freshwater marsh field guides (See Resources listed in the Habitat Overview)
- Insect repellent

Materials: For Each Student

- Student Data Sheets and pencil
- Clipboard (Masonite or stiff cardboard with a paper clip or binder clip)

Arrowhead

Directions

1. Introduce the concept of the food web. Using the poster, point out different animals and discuss what they eat. Stress the role of plants as the primary producers.

Give examples of marsh plants as food. (Consult a food guide, see Resources.) Name some common ones that the students are very likely to see in the marsh.

Examples:

Cattails—muskrats eat leaves, stems, and roots and use them for building their lodges; humans eat the stems and flowers.

Arrowheads—ducks and humans eat the tubers.

Bulrushes—ducks eat the seeds; humans and muskrats eat the roots.

2. Distribute student materials and caution the students to be careful around the marsh, especially near open water. (Review safety procedures.)

3. At the site, the students are to imagine they are pioneers who have chosen to settle near a marsh because of the food and other resources available there. They will evaluate places to build cabins and find food sources.

4. Assign each group a "cabin site" to evaluate, using the student data sheets. Try to choose sites that are different (e.g., one in a low spot; one in the nearby woods; one on a point of land).

Mayfly

5. After evaluating their cabin sites, students should look for things the pioneers might have eaten and list them on their data sheets. If they can't decide whether something is edible, ask them how they think the pioneers would have found out (eat some; ask the Indians; compare it with similar plants they used in their home countries). You might take on the role of an advising Indian by using the food guide. After the students record what pioneers would eat, they should also record how these plants and animals get their food.

Caution: Students must be warned **not** to eat any plants they find on their field trip.

Yellow pollen: mix with pancake flour.
Green flowers: cook like broccoli.
New sprouts: boil or roast.
Roots: grind into fine, white flour.

Cattail

6. Gather students together. Each group should discuss the pros and cons of their various building sites and tell what they found to eat. As they were sampling for food in the marsh, the students probably noticed other creatures (namely insects) trying to eat them. The insects have been annoying to the students, but they are important in the marsh food web. How many of the animals the students found depend on insects for food? (Many—including some species of fish, frogs, turtles, birds, and other species.)

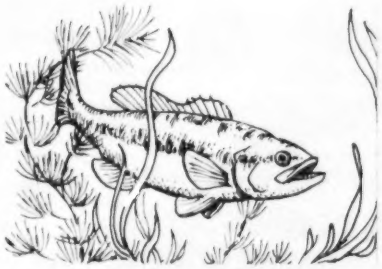
Leopard Frog

Followup

Students used insect repellent to avoid insect bites. What could early settlers (and other animals) do to avoid insects? (Stay in breezy places; go into the water; use "natural" insect repellents, e.g., pennyroyal mint.)

Students might also study other early uses of freshwater marsh resources (besides food and shelter) such as:

- Medicines from plants
- Chairs and mats woven from cattails and reeds
- Quilts stuffed with cattail "fuzz" (dry female flowers)
- clothing made from fur of beavers, muskrats.



Largemouth Bass

Great Blue Heron

Quiz Answers

1. 1-c; 2-d; 3-b; 4-a.

2. Possible answers:

- Flooding (pioneers tried to build their cabins on firm soil that wouldn't flood)
- Biting insects
- Keeping farm animals out of the marsh.

3. Some ways of finding edible things are better than others; in the marsh there are several possibilities.

The pioneers could have:

- Asked the natives (Indians)
- Checked a book (not available to the very first explorers, but plants were recorded very early)
- Found out by trial-and-error (sometimes the errors had dire results)
- Watched what animals ate (not always an accurate indicator for humans)
- Searched for things that looked similar to what they ate in their native countries before they came to America.

4. Any marsh plant or animal is a valid element of the web. If a student has connected things in a way that seems unlikely, check your field guide. (See diagram and Student Page puzzle.)

Freshwater Marsh Lesson Plan 2 Quiz

Name:

1. Draw lines to match the things found in the marsh (Column A) with their values to people (Column B).

A.	B.
1. Fish	a. Baskets
2. Marsh creeks	b. Furs
3. Beavers	c. Food
4. Reeds	d. Water supply

2. Pioneers lived near marshes for many reasons. What are two problems they had to deal with when settling there?

a. _____

_____

b. _____

_____

3. If you were a pioneer settling in a new area, how would you find out what to eat? Can you list two ways?

a. _____

_____

b. _____

_____

4. Draw a food web with at least five animals or plants. Include yourself as one of the animals. You can use either pictures or names. Be sure to draw arrows to show who eats whom.

Department of the Interior/U.S. Fish and Wildlife Service, 1980

Freshwater Marsh

Lesson Plan 3

A Model Marsh

Purpose

Use this classroom activity to reinforce the students' concept of the marsh's structure and to demonstrate the marsh's water resource values. This activity can be used to follow up or lead into the other lessons in this unit.

Learning Outcomes

After completing this activity, the students will be able to:

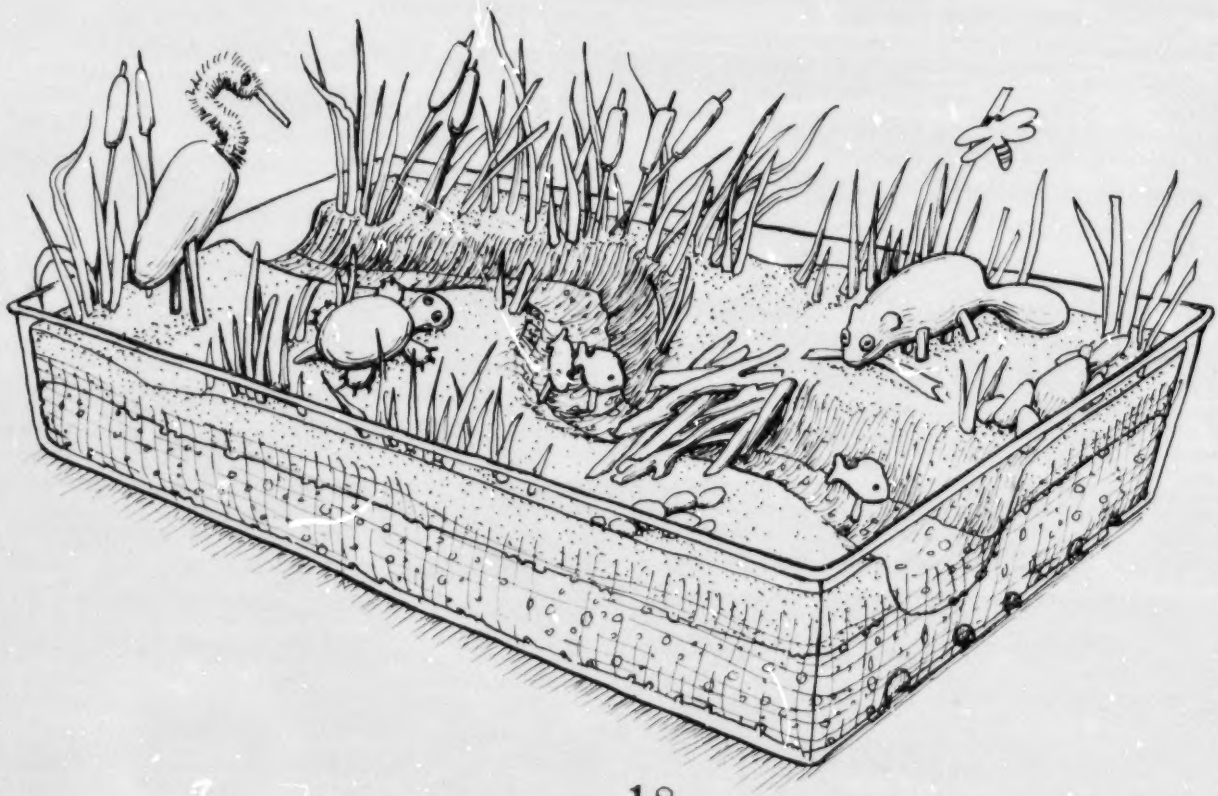
A. Contrast the water-holding properties of a drained marsh with those of an undrained one.

B. Choose from a map which of two towns they would prefer to live in (based on the town's proximity to a marsh) and give three reasons for their preferences.

C. Construct a working model of a marsh.

Organization

Who: Whole Class
Where: Classroom
When: Anytime
Time: 3 to 4 hours



Materials:

- Large shallow pan (e.g., greenhouse germination flat)
- Sand
- Peat, a large sponge, or other absorbent material (florist's Styrofoam)
- Variety of model-building materials:

toothpicks	clay
twigs	pipe cleaners
cheesecloth	dry grass
mud	other

Directions

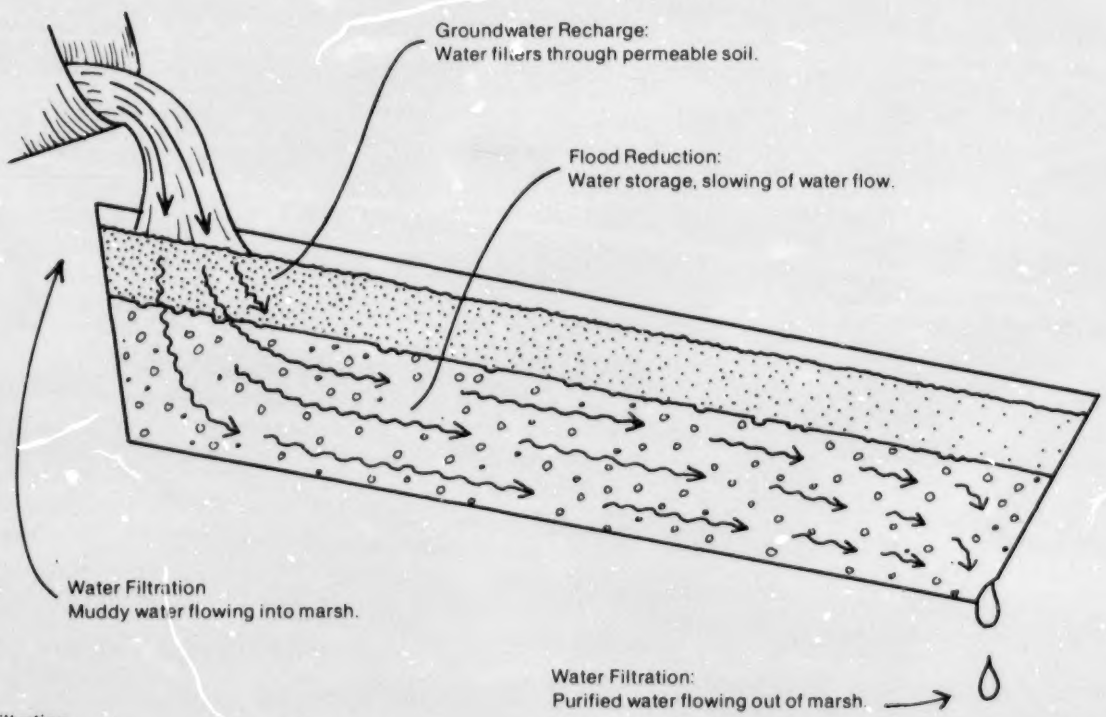
1. Drill a few small holes, 6 millimeters (¼ in) in diameter, near the bottom at one end of the pan to allow water to flow out. On the inside of the pan, cover the holes with cheesecloth so that sand will not fall out. Build an absorbent marsh base by filling the pan with a sand/peat mixture or by putting sand over a large dry sponge.

2. The students construct a model marsh based on what they have seen on their field trip (or on Poster, Side 2), including living and nonliving things. A wide variety of materials can be used to simulate plants and conditions in the marsh. They might mold a shallow, meandering stream channel in the sand base and construct a beaver dam of sticks and mud.

Cattails can be made from toothpicks and clay. Rushes can be simulated by using weedy grasses. Pay particular attention that the students "zone" their plants as they have seen in their outdoor lessons and on the poster. Students should also make models of animals (fish, birds, mammals) and place them where they would be found in the marsh.

3. Tilt the pan slightly with the holes at the lower end. Place another pan under the holes to catch water. Slowly add slightly muddied water to the marsh using a cup. Emphasize that this is only a simulation, but notice how the marsh is able to hold water. Ask the students what would be happening to the water if this water were runoff from rain, or if the marsh were paved over. If there were lots of water (rain), what might happen to areas downstream? Discuss the value of marshes in flood prevention.

Keep adding water until it begins to flow from the holes at the bottom of the marsh. Is it still dirty? Discuss the value of the freshwater marsh in water filtration and pollution reduction.



Water Filtration

Discuss what happens when water is held in the marsh rather than draining away quickly. Let the students visualize a groundwater reservoir under their marsh. Help them visualize impermeable soil by imagining a plastic sheet between the marsh and the groundwater. Will water in the marsh affect the groundwater? (No—water cannot seep through.) How will the marsh water affect this reservoir if the soil, as is usually the case, is permeable to water? What significance will this have when the groundwater is being pumped for human use? (Water seeping down will replace some of the water being pumped out.)

Notes

Quiz Answers

1. A freshwater marsh can protect a town by:

a. Storing water that might otherwise flood the town.

b. Filtering its water supply, thereby preventing disease.

c. Helping recharge groundwater, thereby ensuring water supplies.

2. b. is not correct—freshwater marshes do not add pollutants to water.

3. Students should prefer to live in Town A. Possible reasons:

- Town A is less likely to flood.
- Town A might have a cleaner water supply.
- Town A might have a more constant groundwater supply.
- They can go to the marsh for an outing (fish, picnic, etc.) and see wildlife.

4. False. Water seeps into groundwater reservoirs from the surface, so both the quality and quantity of groundwater can be affected by surface conditions.

Freshwater Marsh Lesson Plan 3 Quiz

Name:

1. Tell how a freshwater marsh can help protect a town from a natural disaster.

_____

_____

_____

_____

_____

2. Circle the answer that is not correct.
a. Freshwater marshes help fight water pollution.
b. Freshwater marshes can sometimes pollute the water supplies.
c. Freshwater marshes sometimes filter groundwater.

3. This map shows two towns. Town A is located downstream from a freshwater marsh. Town B is built on a marsh that has been paved over. Which town would you prefer to live in? (Circle your answer.)

Town A **Town B**

Give three reasons why you chose that town to live in:

a. _____

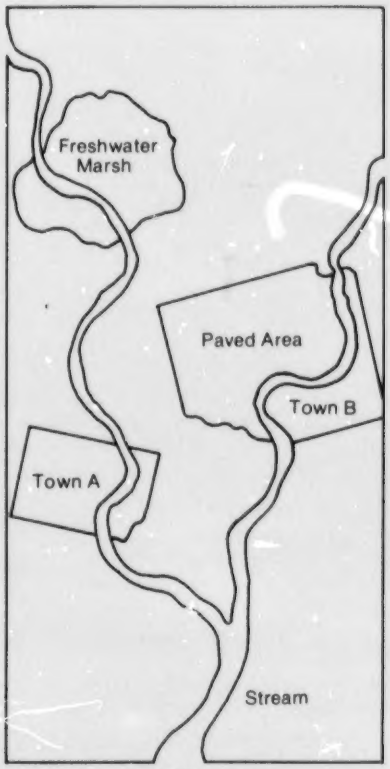
_____

b. _____

_____

c. _____

_____



Map of Town A and Town B

4. Underground water supplies cannot be affected by conditions on the land's surface. (Circle your answer.)

True **False**

Department of the Interior/U.S. Fish and Wildlife Service, 1980

Plot 1 **Marsh**	Soil (color, moisture, texture)		**Plot 2** **Edge**	Soil (color, moisture, texture)		**Plot 3** **Upland**	Soil (color, moisture, texture)	
Organism (Plant or animal)	Number Found	Where Found	Organism (Plant or animal)	Number Found	Where Found	Organism (Plant or animal)	Number Found	Where Found

Name:

Department of the Interior/U.S. Fish and Wildlife Service, 1980

Freshwater Marsh **Lesson Plan 2** **Data Sheet**

Name:

Cabin Site #	Yes	No
1. Is the soil firm?		
2. Will the site flood in the spring? (What if a beaver builds a dam in the creek nearby?)		
3. Will your farm animals wander onto soft ground and become trapped in mud?		
4. Are there building materials nearby?		
5. Is there transportation nearby? (A creek, maybe.)		
6. Is water easily available and safe to drink? (Remember you have to carry it in buckets.)		
7. Can you get food easily?		
8. Will bugs be a problem? (Will there be a lot of them around? More than in other places? Will you have a breeze to keep them away?)		
9. Will winter winds be too cold?		
10. Would you build your cabin here?		

Name:

Name or describe 7 things in the marsh that pioneers might have eaten. Can you find these things in this area? Are there many or only a few of each? How do these things get their food?

Something a Pioneer would eat:	Are there many or few?	How does it get its food?
1.		
2.		
3.		
4.		
5.		
6.		
7.		

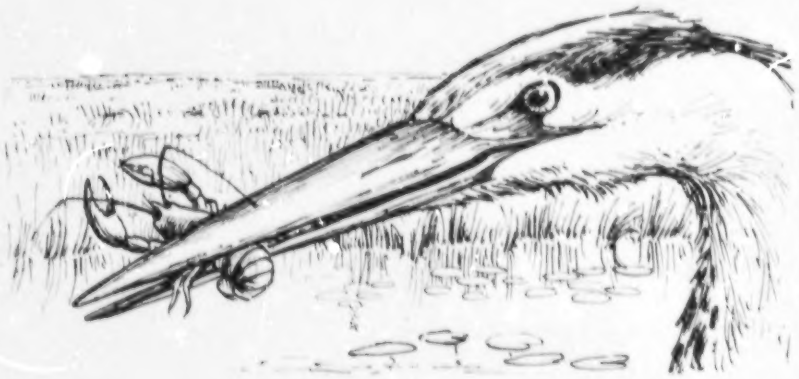
Department of the Interior/U.S. Fish and Wildlife Service, 1980

Name:

Every creature has to eat. Some food comes from plants and some from animals. Most creatures eat many different things. Plants and animals, including humans, are all linked in a "food web."

Here is a simplified food web from a freshwater marsh area where pioneers might have settled 200 years ago. Read the clues and see if you can work out the web. Use the words below to fill in the correct numbered places. (Note: The arrows point away from the "food" toward the creature that eats it.)

mayfly	snake
crayfish	owl
heron (wading bird)	bass (fish)
plants	muskrat
mouse	frog
	human



Clues

1. These living things use energy from the sun to make food. They provide the most food in the entire world.

2. This small marsh rodent eats plants and sometimes insects.

3. The larva of this flying insect feeds on plants.

4. This creature eats insects; it stays close to water but is sometimes found on land.

5. This animal lives all its life in the water and feeds on insects and frogs.

6. This bird hunts at night for snakes and mice.

7. This small mammal was hunted for its fur; its meat was also eaten. It eats mostly plants.

8. This long-legged bird wades among plants in shallow water, looking for fish and frogs.

9. This creature can find many things to eat in the marsh, including plants, fish, frogs, crayfish, and muskrats.

10. This long reptile hunts for frogs and mice. It swallows its prey whole.

11. This creature looks like a small lobster and swims backwards. It eats small dead fish, insect larvae, and plants.

Answers: 1. plants, 2. mouse, 3. mayfly, 4. frog, 5. bass, 6. owl, 7. muskrat, 8. heron, 9. human, 10. snake, 11. crayfish

Name: